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Original Research Article

Outcome Assessment of Fracture Distal End of Radius Treated with Percuteneous Multiple K-Wire

Binay Kumar[1], Anshu Anand[2], Ajoy Kumar Manav[3]

[1]Senior Resident, Department of Orthopaedics, Patna Medical College and Hospital, Patna, Bihar, India
[2]Senior Resident, Department of Orthopaedics, Patna Medical College and Hospital, Patna, Bihar, India
[3]Associate Professor and Unit Head, Department Of Orthopaedics, Patna Medical College and Hospital, Patna, Bihar, India

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Corresponding Author: Dr. Anshu Anand
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Abstract

Aim: The aim of the present study was to assess the fracture distal end of radius treated with percuteneous multiple k-wire.

Methods: This was a prospective, comparative observational study was conducted in the Department of Orthopaedics, PMCH, Patna. About 75 patients with Distal Radial Fractures presented to PMCH, Patna, Bihar, India All 50 patients, who fulfilled the inclusion criteria, were included in the study.

Results: The majority was men (64%). Majority of the patients (70%) sustained the injury due to fall. The side of involvement was nearly equal and that there was no predominance of the either sides. Majority of the patients (80%) did not have associated injuries. In our study, according to AO classification, 29 cases were of Type A, 15 were of Type B and 6 were of Type C. In our study, 70% of the cases showed ―Excellent, 24% of the cases showed ―Good, 4% cases showed―Fair and only 2% cases showed ―Poor result. At final follow-up by the Gartland & Werley Criteria for Functional Outcome 35 (70%) patients had―Excellent result, 12 (24%) had ―Good result, 2 (4%) had ―Fair result and 1 (2%) had a ―Poor result. There were no major complication noted except for pin site infection in 8 (16%) cases and pin loosening in 2 (4%) cases.

Conclusion: This study demonstrated that percutaneous Kirschner wire pinning is a minimally invasive technique that provides an effective means of maintaining the anatomical fracture reduction. It does not required highly skilled personnel or sophisticated tools for application. It is a suitable method for fixation of displaced Colles fracture with minimal intra-articular involvement. The technique involves a minimal procedure that provides anatomic reduction, fracture fixation, and maintenance of reduction with an adequate method of immobilization.

Keywords: Distal Radius Fracture, Percutaneous Kirschner Wire Fixation.

Introduction

Distal radius fractures account for 17% of all fractures in adults. Thousands of articles were published after Abraham Colles described a very common fracture of the distal end radius in 1814 in the Edinburgh Medical and Surgical Journal, have not yet created a consensus as a treatment programme. [1] The fracture of the lower end of radius crush the mechanical foundation of man's most elegant tool, the hand. No other fracture has a greater potential to devastate hand function. [2] A thorough understanding of the pathophysiology and treatment of distal end radius is important as high energy trauma to distal end radius in adults is becoming more common and long term functional results are unclear, these common injuries must be evaluated thoroughly and treated adequately. The causes of injury are fall on outstretched hand, work related accidents, car accidents, sport injuries. [2]

The typical mechanism of a dorsally displaced distal radius fracture is a fall on outstretched hand. This type of injury results in tensile forces across the volar surface (compression side) compressive forces on the dorsal surface (tension side), and supination of the distal fracture fragment. Compression and torsion across the articular surface can cause various patterns of intra-articular displacement. Stable reduction of the distal radius fractures requires this biomechanical relationship to be re-established. [3] Studies have shown that distal radius fractures are associated with tears of the triangular fibrocartilage complex (TFCC), scapholunate ligament, lunotriquetral ligament.

Generally the carpal ligament injuries including TFCC that are associated with distal radius fractures that do not show visible deformities on plain radiographs are not treated. Accurate fracture reduction results into healing of the ligaments during the post-operative or postreduction immobilisation period. [4]

Distal radius fractures are the most common type of orthopedic fracture. Some surgeons advocate treatment by manipulation and plaster immobilization. [5] Many recommend operative intervention as the only methods to obtain anatomical reduction, and some have proposed that the best functional result will only be achieved by obtaining as near an anatomical radiographic result as possible. [6] Although a study by Young and Rayan [7] found favorable outcomes in low-demand older-aged patients despite deformity, most authors agreed that radial shortening more than 4 mm and radial dorsal angulation of more than 11° would reduce range of motion of the wrist.

The treatment options are quiet varied depending on the exact nature of fracture, activity level and surgeons personal preferences. There are no contraindications to the nonsurgical management of a closed distal radius fracture. Indications for surgical treatment should be based on radiographic findings after initial reduction, expected functional needs, associated medical conditions and other traumatic injuries. [8]

The aim of the present study was to assess the fracture distal end of radius treated with percuteneous multiple k-wire

Materials and Methods

This was a prospective, comparative observational study was conducted in the Department of Orthopaedics, PMCH, Patna. About 50 patients with Distal Radial Fractures presented to PMCH, Patna were included in the study. 50 patients, who fulfilled the inclusion criteria, were included in the study. The patients were followed up for an average period of 6 months. During the follow up, X-rays were taken and the patients were assessed. Anatomical analysis was done using ‗Sarmiento's Modification of Lind storm Criteria and functional analysis was done using ‗Sarmiento et al Modification of Demerit Point System of Gartland & Werley‖.

Inclusion Criteria

Inclusion criteria were sustained a fracture of the distal radius (comminuted extra-articular and intra-articular), they were over the age of 18 years, the patients presented within 2 weeks of injury.

Exclusion Criteria

Exclusion criteria were open fracture with a Gustillo- Anderson grading greater than 1, fractures which required open reduction / ligamentotaxis (external fixator).

Surgical Procedure

The patient was positioned supine on the OT table, with the limb on a side table. Under regional anaesthesia (if unsuccessful then it was converted to general anaesthesia at the discretion of the anaesthetist) the parts were painted and draped. The fracture alignment was achieved by traction – counter traction and the reduction confirmed by the image intensifier. 1.5 or 2 mm K-wire was passed from the radial styloid crossing the fracture site obliquely to exit the dorsoulnar cortex of the radial shaft. Another K-wire was passed either parallel to the first wire or from the dorsoulnar aspect of the distal radius between the 4th and 5th extensor compartments and directed to engage the volar radial cortex of the proximal fragment. The exposed ends of the K-wires were then bent and cut. The pin sites were then dressed. Then a below elbow slab was applied on the volar surface with the wrist in neutral position.

Postoperative Protocol

In the post-operative period, the limb was kept strictly elevated for a period of 2 days. Patient was encouraged to begin active finger movements as soon as the effect of anaesthesia wore out. Patient at the end of 2 days asked to mobilize his elbow. At this time the pin sites were inspected and then dressed. If pin sites and mobilization were satisfactory, the patient was then discharged the next day.

Follow-up

Patient was asked to review weekly for pin site inspection and follow up. At the end of four weeks a check X-ray was taken and if satisfactory signs of union were present, the pins were removed as was the slab and patient given a crepe bandage. He was then asked to mobilize the wrist gently at home. If at four weeks union was not satisfactory then, patient was followed up at five and then six weeks. At the end of which, the K-wires were removed and patient was asked to mobilize the wrist. We did not encounter any case not showing satisfactory union at 6 weeks. The patient was reviewed at the end of a month after removal of pins as regard to range of motion of the wrist. If there was no satisfactory range of movements, patient was advised to visit the physiotherapist.

Results

Table 1: Demographic and other characteristics of the study participants

Sex distribution	Number of cases	Percentage
Male	32	64
Female	18	36
Mode of Injury		
Fall	35	70
RTA	15	30
Side Involved		
Left	24	48
Right	26	52
Associated Injuries		
No	40	80
Yes	10	20

The majority was men (64%). Majority of the patients (70%) sustained the injury due to fall. The side of involvement was nearly equal and that there was no predominance of the either sides. Majority of the patients (80%) did not have associated injuries.

Table 2: Cases as per AO classification among study participants

AO type	Number of Cases	Percentage
A	29	58
B	15	30
C	6	12

In our study, according to AO classification, 29 cases were of Type A, 15 were of Type B and 6 were of Type C.

Table 3: Results of the functional outcome analysis among study participants

Result	Subjectiveevaluation	End result
	Number of cases (%)	Number of cases (%)
Excellent	30 (60%)	35 (70%)
Good	16 (32%)	12 (24%)
Fair	3 (6%)	2 (4%)
Poor	1 (2%)	1 (2%)

In our study, 70% of the cases showed ―Excellent, 24% of the cases showed ―Good, 4% cases showed―Fair and only 2% cases showed ―Poor result.

Table 4: Comparison of results between the functional and anatomical outcome

Result	Gartland & Werley	Sarmiento
Excellent	70%	62%
Good	24%	28%
Fair	4%	10%
Poor	2%	0%

At final follow-up by the Gartland & Werley Criteria for Functional Outcome 35 (70%) patients had―Excellent result, 12 (24%) had ―Good result, 2 (4%) had ―Fair result and 1 (2%) had a ―Poor result.

Table 5: Complications

	Number of cases	Percentage
Pin Site Infection	8	16
Pin Loosening	2	4

There were no major complication noted except for pin site infection in 8 (16%) cases and pin loosening in 2 (4%) cases.

Discussion

Fractures of the distal radius constitute one of the most common skeletal injuries treated by Orthopaedic surgeons. These injuries account for one sixth of all fractures evaluated in emergency room. They make up 8%−15% of all bony injuries in adults. [9] Vast majority of fractures of distal radius are articular injuries that result in disruption of both radio-carpal and radio-ulnar joints. Better understanding of the spectrum of distal radius fractures has led to changing concepts of treatment. [10] The optimal method of obtaining and maintaining an accurate restoration of distal radial anatomy remains a topic of considerable controversy. Wide arrays of techniques, including closed, percutaneous and open methods of

reduction and stabilization have been increasingly advocated as successful treatment. [11] Fracture of the distal radius was first described by Pouteau (1783) and then by Colles (1814). [12]

Most of the fractures are caused by a fall on the outstretched hand with the wrist in dorsiflexion. The form and severity of fracture of distal radius as well as the concomitant injury of disco-ligamentary structures of the wrist also depend on the position of the wrist at the moment of hitting the ground. The width of this angle influences the localization of the fracture. Pronation, supination and abduction determine the direction of the force and the compression of carpus and different appearances of ligamentary injuries. [13] The majority was men (64%). Majority of the patients (70%) sustained the injury due to fall. The side of involvement was nearly equal and that there was no predominance of the either sides. Majority of the patients (80%) did not have associated injuries. In our study, according to AO classification, 29 cases were of Type A, 15 were of Type B and 6 were of Type C. An accurate reduction in the fracture is the first step in the treatment of the distal radius fracture. After anatomic reduction in the fracture is achieved, many methods are available to maintain alignment and prevent repeat displacement. The methods of immobilization include casting, percutaneous pinning, external fixation, internal fixation with plate, or internal fixation combined with external fixation depending on the different types of fractures. Every method has its advantages and some limitations. [14]

In our study, 70% of the cases showed ―Excellent, 24% of the cases showed ―Good, 4% cases showed―Fair and only 2% cases showed ―Poor result. Study by Uzzaman et al showed anatomical results (acc. To Sarmiento and Latta‘s score) was satisfactory in 80% cases of percutaneous K-wire fixation group whereas in conventional group it was 35%. [15] Spira and Weigl reported a 51.4% unsatisfactory result with reduction and use of cast in the treatment of comminuted fracture of distal radius with articular involvement. [16] Closed reduction and percutaneous pinning relies on intrafocal manipulation and pinning or manual traction, reduction, and pinning, to hold the fracture in an appropriate anatomic alignment. Clancey reported a 96.4% satisfactory result in 30 patients treated with percutaneous pinning if the articular surface of the radius was not comminuted into more than two fragments. [17]

At final follow-up by the Gartland & Werley Criteria for Functional Outcome 35 (70%) patients had―Excellent result, 12 (24%) had ―Good result, 2 (4%) had ―Fair result and 1 (2%) had a ―Poor result. There were no major complication noted except for pin site infection in 8 (16%) cases and pin loosening in 2 (4%) cases. Because K-wire fixation seldom provide sufficient stability to allow for early motion and often necessitate use of a cast or splint, the addition of two K-wires incorporated into the pin-in-plaster could increase stability of the fracture fixation. Extreme wrist flexion and ulnar deviation could be avoided with this technique. Percutaneous pinning with Kirschner wire is simple, minimally invasive, and prevents re-displacement of fracture fragments but it is limited to the extra-articular Colles fracture or fractures with minimal intra-articular involvement. [18]

Conclusion

This study demonstrated that percutaneous Kirschner wire pinning is a minimally invasive technique that provides an effective means of maintaining the anatomical fracture reduction. It does not required highly skilled personnel or sophisticated tools for application. It is a suitable method for fixation of displaced Colles fracture with minimal intra-articular involvement. The technique involves a minimal procedure that provides anatomic reduction, fracture fixation, and maintenance of reduction with an adequate method of immobilization.

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